

REMARKS

This is a full and timely response to the outstanding non-final Office Action mailed May 17, 2005. The Examiner is thanked for the thorough examination of this application and the allowance of claims 26-36. Claims 37-47, however, stand rejected. For at least the reasons set forth herein, Applicants respectfully request reconsideration and withdrawal of the rejections.

Discussion of Rejections Under 35 U.S.C 102(e)

Claims 46 and 47 have been tentatively rejected under 35 U.S.C 102(e) as allegedly anticipated by Yu et al. (US 6,459,141 B1). Applicant respectfully traverses the rejections made by the Office Action for the reasons discussed below.

Yu et al fail to teach or suggest at least the claimed forming the two indium doped regions having different concentrations, as recited in claim 46.

Among other features, claim 46 recites:

46. ...

...

a first doped region *having a first indium concentration* adjacent to top corners of said trench isolation structure; and

a second doped region *having a second indium concentration* at a bottom of said trench isolation structure;

wherein said first indium concentration is higher than said second indium concentration.

It is therefore clear that the two indium doped regions having different concentrations are formed nearby the trench isolation in the substrate. One is adjacent to top corners of said trench isolation, and the other is at the bottom thereof.

In contrast, Yu apparently teaches forming a shallow well layer having an indium concentration gradient, a buried amorphous layer having a silicon concentration gradient, and a

deep well layer having a boron concentration gradient extending between two isolation trenches in a substrate (see column 2, lines 10~56). However, Yu fails to address or disclose a doped region in the bottom of the trench isolation. Consequently, Yu fails to disclose the claimed two indium doped regions having different concentrations which are adjacent to top corners and at bottom of trench isolation.

For at least this reason, claim 46 patently defines over Yu. Insofar as claim 47 depends from claim 46, claim 47 also defines of the cited are for at least the same reasons.

Discussion of Rejections Under 35 U.S.C 103(a)

Claims 37-45 have been tentatively rejected under U.S.C 103(a) as allegedly unpatentable over Puchner (US 6,342,429) in view of Noble (US 5,726,095). Applicants respectfully traverses the rejections for the reasons discussed below.

Neither of the cited references teaches or suggests forming the indium doped region adjacent to top corners of trenches and extending under gate dielectric layer, as recited in claim 37.

Among other features, claim 37 recites an indium doped region formed in an active area adjacent to top corners of shallow trenches and extending under part of a gate dielectric layer.

Specifically, claim 37 recites:

37. A NMOS transistor having an improved narrow width V_t roll-off, comprising:

a substrate that includes shallow trench isolation (STI) features which are comprised of a shallow trench with sloped sidewalls and a bottom, an oxide liner formed on said shallow trench sidewalls and bottom, and an insulator layer formed on said oxide liner that fills said shallow trench and extends to a level that is above the top of said substrate;

an active area formed between two adjacent shallow trenches in said substrate;

a gate dielectric layer formed on said active areas; and
a patterned gate layer formed on said gate dielectric layer wherein said gate layer extends over said adjacent shallow trenches;
wherein said active area having ***an indium doped region that is adjacent to top corners of said shallow trenches and extends under part of the gate dielectric layer by performing an angled implant of indium ions.***

(Emphasis added.)

In contrast, Puchner teaches forming an indium doped region at sidewalls and bottom of a trench (see FIG. 2D, and column 3, lines 63~64). The Office Action alleges that “the indium is driven through the oxide at the corners of the STI trench and diffused from the silicon below the corners of the STI to extend underneath the gate dielectric layer by the subsequent thermal cycles.” (see Office Action, page 5, lines 1~7). However, Puchner expressly admits that the indium does not tend to diffuse (see FIG. 2D, and column 4, lines 16~20) and exhibits only a limited mobility to maintain a high concentration at the oxide/silicon interface (see column 5, lines 46~47). Accordingly, contrary to the position taken by the Office Action, the implanted indium will not diffuse out the top corners of the trenches and extend underneath the gate dielectric layer during the subsequent thermal treatments. For at least this reason, the rejection of independent claim 37 is misplaced and should be withdrawn.

A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983).

Additionally, Noble also fails to teach any indium doped region under a gate dielectric layer (see FIG. 3L and column 6, lines 14~22). Clearly, the combination of the cited references neither discloses an indium doped region extending under part of a gate dielectric layer.

Accordingly, Applicants respectfully submit that the cited references fail to disclose or render obvious the feature of the above-discussed present invention as set forth in claim 37. Therefore, claim 37 is allowable over the cited references. Insofar as claims 38~45 depend from claim 37, these claims are also allowable.

Cited Art of Record

The cited art of record has been considered, but is not believed to affect the patentability of the presently pending claims.

CONCLUSION

In light of the foregoing amendments and for at least the reasons set forth above, Applicant respectfully submits that all objections and/or rejections have been traversed, rendered moot, and/or accommodated, and that the pending claims are in condition for allowance. Favorable reconsideration and allowance of the present application and all pending claims are hereby courteously requested. If, in the opinion of the Examiner, a telephonic conference would expedite the examination of this matter, the Examiner is invited to call the undersigned attorney at (770) 933-9500.

No fee is believed to be due in connection with this Amendment and Response. If, however, any fee is believed to be due, you are hereby authorized to charge any such fee to deposit account No. 20-0778.

Respectfully submitted,

By: 
Daniel R. McClure, Reg. No. 38,962

Thomas, Kayden, Horstemeyer & Risley, LLP
100 Galleria Pkwy, NW
Suite 1750
Atlanta, GA 30339
770-933-9500